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(54) **VALVE ASSEMBLY**

VENTILANORDNUNG

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Description

[0001] The present invention relates to a valve assembly. In particular, though not exclusively, the invention relates to a flapper valve assembly.

[0002] Flapper valves are widely used in fluid conduits that transfer fluids between an oil or gas reservoir and a wellhead. Flapper valves are typically hinged at one side of the conduit and pivotable in an arc 90° about the hinge to move between an open and a closed configuration. In the open configuration, the valve is disposed generally parallel to the longitudinal axis of the throughbore of the conduit and is therefore removed from the throughbore to allow fluids to flow therethrough. In the closed configuration, the valve lies perpendicular to the longitudinal axis of the throughbore to obturate the bore of the conduit. However, conventional flapper valves have the disadvantage that they are unidirectional i.e. they only seal and hold pressure in one direction.

[0003] Examples of such conventional flapper valves are shown in the following patent publications:-

US2006/0162939 which is considered the closest prior art, discloses a dual flapper safety valve where two flapper valves are arranged in series for controlling flow through a pair of respective safety valves.
US Patent Publication 2006/0011354 discloses a flapper valve that can pivot open or closed.
European Patent Publication No EP0760418 also discloses a flapper valve that can pivot open or closed and again US Patent No 3144876 discloses a flapper valve that can pivot open or closed.

[0004] According to a first aspect of the present invention there is provided a valve assembly in accordance with claim 1.

[0005] The shape of the sealing line can be non-planar.

[0006] Preferably, the sealing member is non-circular in plan and preferably is longer than it is wider. The sealing member can be non-planar. More preferably, the sealing member can be arcuate. At least one face of the sealing member can be curved around the longitudinal axis of the throughbore and more preferably a central axis of the sealing member is arranged to be parallel to the longitudinal axis of the throughbore, when in the open configuration. The curve of the at least one face of the sealing member around the longitudinal axis can have a substantially constant radius. A sealing member having such a shape can take up less space and thus improve space efficiency of the apparatus when the sealing member is in the open configuration.

[0007] The sealing member can have a convex face and the sealing line can be arranged along the convex face of the sealing member.

[0008] The sealing member can be substantially spade, teardrop or egg- shaped in plan view.

[0009] An outer edge of the sealing member can be shaped to conform to an inner surface of the conduit.

[0010] In the open configuration, the throughbore is open allowing passage of fluids therethrough. In the sealing configuration, the sealing member substantially obturates the throughbore to restrict passage of fluids therethrough.

[0011] In the sealing configuration, the valve assembly can retain pressure across the seal in one direction. More preferably, the valve assembly can retain pressure across the seal in both directions.

[0012] Typically fluids predominantly flow through the conduit in one direction. The sealing line can be arranged along an upstream face of the sealing member.

[0013] The sealing member can be pivotally coupled to the sealing mechanism and more preferably can be pivotally movable within the bore.

[0014] The sealing member can be pivotable through less than 90° of rotation to move between the open configuration and the sealing configuration. More preferably, the sealing member is pivotable through less than 70° of rotation to move between the open configuration and the sealing configuration. More preferably, pivotal movement of the sealing member of less than 50° and most preferably around 45° allows the sealing member to move between the open and the sealing configuration.

[0015] The sealing member can comprise pivotally attached first and second portions. The first portion can be movable only in an axial direction. The second portion can be movable axially due to its attachment to the first portion as well as pivotally through pivot of the second portion relative to the first portion.

[0016] The sealing mechanism can be hydraulically actuable and is preferably coupled to a hydraulic actuation system.

[0017] The valve seat can be shaped to conform with the profile of the sealing member along the sealing line. The sealing line is preferably the line along which the valve seat and the sealing member are in contact when in the sealing configuration.

[0018] Alternatively, the sealing line can be the line along which a seal is made between an inner surface of the conduit and the sealing member.

[0019] The valve seat can be moveable between a stowed configuration and a spaced configuration. In the stowed configuration, the sealing member engages the valve seat when the sealing member is in the sealing configuration. In the spaced configuration, the sealing member is spaced from and movable relative to the valve seat.

[0020] The valve assembly can further comprise a second valve seat for selective sealing against the sealing member.

[0021] Preferably, both of the first and second valve seats can move relative to the sealing member. The sealing member can preferably seal against both of the valve seats in the sealing configuration.

[0022] The first valve seat can be shaped to guide the sealing member towards the sealing configuration. The first valve seat is preferably shaped to conform with the

profile of the sealing member along the sealing line.

[0023] The second valve seat can be axially moveable within the bore.

[0024] The second valve seat can be mounted on an end face of a sleeve that is slideable within the bore of the conduit.

[0025] The sleeve is preferably hydraulically operable. The sleeve can be hydraulically coupled to the hydraulic actuation system also used to open the sealing mechanism.

[0026] The hydraulic system of the valve assembly can be actuable by at least one of the following means selected from the group consisting of: a timer; radio frequency signals; a pressure pulse; and electromagnetic induction.

[0027] Alternative methods of actuation of the sealing mechanism include applied pressure using control lines and mechanically driven means, such as different types of motor.

[0028] The valve assembly is preferably resettable in that it is preferably repeatably moveable between the open and sealing configurations. The valve assembly can comprise a reset system, the actuation of which can cause movement of the valve assembly from the sealing configuration to the open configuration.

[0029] Where the valve assembly incorporates a reset system, the reset system can be responsive to at least one of the following means selected from the group consisting of: a timer; a radio frequency signal: a pressure pulse; a mechanical driving means; and electromagnetic induction, for selective movement of the valve assembly into a predetermined configuration.

[0030] The valve assembly can be a flapper valve assembly. The sealing member of the valve assembly can be a flapper.

[0031] The flapper valve and the at least one valve seat can be shaped such that movement of the sealing member from the open into the sealing configuration cleans the valve seat.

[0032] The self-cleaning action can be achieved by contact between the sealing member and the valve seat as the sealing member is moved into the sealing configuration, since the moving contact between the sealing member and the valve seat can scrape debris from the valve seat.

[0033] Embodiments of the present invention will now be described, by way of example only, and with reference to the accompanying drawings, in which:-

Figs. 1 a and 1 b are, respectively, a partial cutaway plan view and a sectional view of a valve assembly in its open configuration;

Fig. 1 c is an end view of the valve assembly of Fig. 1a;

Figs. 2a and 2b are, respectively, a partial cutaway plan view and a sectional view of the valve assembly of Figs. 1 a and 1 b showing the sealing member exposed in its open configuration;

Figs. 3a and 3b are, respectively, a partial cutaway plan view and a sectional view of the valve assembly of Figs. 1 a and 1 b but showing the sealing member substantially obturating the throughbore;

Figs. 4a and 4b are, respectively, a partial cutaway plan view and a sectional view of the assembly of Figs. 3a and 3b in its sealing configuration; and

Fig. 4c is an end view of the valve assembly of Fig. 4a.

[0034] The valve assembly is shown generally at 10 in the figures and comprises a substantially tubular body having an upper sub 12, a middle sub 14 and a lower sub 16. The subs 12, 14, 16 are connected together by means of conventional threaded pin and box connections and are sealed by O-rings. When connected, the subs 12, 14 and 16 define a central longitudinal axis 18 and a throughbore 19 that acts as a conduit for the flow of fluids through the tubular body. Outer ends of the top sub 12 and the bottom sub 16 have respective end box and pin connections in order to connect the valve assembly 10 to adjacent lengths of tubing to make up the valve assembly 10 as part of a tubing string. In this way, the valve assembly 10 can be incorporated into a production tubing string and run into a downhole wellbore for the recovery of hydrocarbons from hydrocarbon reservoirs.

[0035] The middle sub 14 accommodates two flow tubes. An upper flow tube 13 is provided adjacent the top sub 12 so that an inner surface of the top sub 12 and an inner surface of the upper flow tube 13 are substantially contiguous in that they share the same internal diameter. The middle sub 14 also carries a middle flow tube 40 that is dimensioned to be a close sliding fit thereagainst. The middle flow tube 40 has a debris barrier 47 in the form of a Teflon™ ring to restrict debris collection in an annulus between the middle sub 14 and an outer part of the middle flow tube 40.

[0036] The longitudinal axis 18 of the throughbore 19 is offset relative to a central longitudinal axis of the middle sub 14 as can be seen in Fig. 1c, such that one side of each of the flow tubes 13, 40, abuts the inner surface of the middle sub 14. On the opposing side, the flow tubes 13, 40 have a thicker sidewall to accommodate a hydraulic sealing mechanism shown generally at 80. The end view of Fig 1 c shows that the outer housing of the subs 12, 14, 16 extends radially outwardly relative to the throughbore 19 to a greater extent on one side of the valve assembly 10 than the other. This creates an arcuate pocket 15 in which the hydraulic sealing mechanism 80 is accommodated and in which a sealing member in the form of a flapper valve 20 is housed when in the open configuration.

[0037] The sealing mechanism 80 comprises a first piston chamber 45 that lies parallel to the longitudinal axis 18 and is in fluid communication, via a port 46, with a hydraulic line 17 running through a side wall of a top sub 12. The hydraulic line 17 connects the hydraulic sealing mechanism 80 to an external supply of hydraulic fluid.

One end of a piston 42 is sealed within the chamber 45 and the other end of the piston 42 is attached to a protrusion 41 extending radially outwardly from one side of the middle flow tube 40. A second piston 48 is attached to the opposing side of the protrusion 41 so that the pistons 42, 48 and the middle flow tube 40 are rigidly connected and moveable as one unit. The second piston 48 is sealed in a second chamber 43 that is in fluid communication with a hydraulic fluid line 44 that also leads to an external supply of hydraulic fluid.

[0038] A hydraulic actuation system (not shown) produces two controlled outputs, one of which is arranged to supply the fluid line 17 and the other is arranged to supply the fluid line 44. Signalling mechanisms can be used to actuate the hydraulic system. These signalling mechanisms can include RFID tags (such as disclosed in UK Patent No GB2420133) to initiate pre-programmed activities, or hydraulic control lines that extend from surface. Pressure pulses in the bore could also be used to actuate the hydraulic system.

[0039] A third piston 22 is sealed within a third chamber 23 arranged substantially parallel to the second chamber 43. The second piston chamber 43 has a hydraulic connecting line 26 allowing selective fluid communication between the second piston chamber 43 and the third chamber 23, but only when the second piston 48 uncovers the hydraulic connecting line 26. The third piston 22 is rigidly attached to a collar 28 that carries the flapper valve 20. As will be appreciated by those skilled in the art, although the flapper valve 20 is intended for operation in the circular cross-section throughbore 19, the flapper valve 20 itself is not circular in plan view but rather is longer than it is wider. Moreover, the flapper valve 20 in a plan view (Fig. 1a) is substantially spade, egg- or teardrop shaped. The flapper valve 20 as shown in Fig. 2b has a central axis along its length that is straight and parallel to the longitudinal axis of the throughbore when the valve 20 is in the open configuration and has arcuate sides at each side of the central axis that curve to follow a similar radius of curvature as the lower end of the middle flow tube 40. The flapper valve 20 is pivotally coupled to the collar 28 via a hinge 21 acting as a pivot point. Therefore, the flapper valve 20 is moveable both axially by the movement of the piston 22 attached to the collar 28 and pivotally via the hinge 21.

[0040] The bottom sub 16 has a lower flow tube 60 positioned adjacent thereto such that an inner surface of the bottom sub 16 is contiguous within an inner surface of the lower flow tube 60. The lower flow tube 60 has a shaped sealing seat 61 that is arranged to guide the flapper valve 20 into a sealing configuration, on axial movement of the collar 28, and allow the flapper valve 20 to seal thereagainst. The sealing seat 61 of the lower flow tube 60 is shaped to match and seal against a rear face of the flapper valve 20.

[0041] The outer diameter of the middle flow tube 40 is a sliding fit within the middle sub 14 and the middle flow tube 40 is slideable between the end of the upper flow tube 13 and the flapper valve 20 in the throughbore 19 in a sealing configuration or the sealing seat 61 of the lower flow tube 60 in an open configuration. A contact edge 49 (Figure 3a) of the middle flow tube 40 is shaped to match and abut a leading edge of the flapper valve 20. The flapper valve 20 is movable between an open configuration in which the throughbore 19 of the valve assembly 10 is open (shown in Figs 1 a-c) and a sealing configuration in which the throughbore 19 of the valve assembly 10 is closed and fluid passage therethrough is restricted (shown in Figs 4a-c).

[0042] Prior to use of the valve assembly 10, the ends of the valve assembly 10 are connected to lengths of pipe in a tubing string that is run downhole. The valve assembly 10 is run downhole with the flapper valve 20 in the open configuration as shown in Figs. 1 a-c. The flapper valve 20 is accommodated within the arcuate pocket 15 and retained in this configuration by the middle flow tube 40 that prevents the flapper valve 20 from pivoting into the throughbore 19. The contact face 49 of the middle flow tube 40 abuts the sealing seat 61 of the lower flow tube 60 in order that the throughbore 19 of the valve assembly 10 remains open and fluids can flow therethrough.

[0043] It is often required to set a packer or to pressure test the tubing string prior to commencement of other operations. The flapper valve 20 of the valve assembly 10 can be used to seal or block the throughbore 19 and thereby provide a pressure retaining barrier to conduct these operations. In such a requirement, an operator sends a command to the hydraulic system, which supplies fluid through the hydraulic line 44 that is in fluid communication with the second chamber 43. As fluid collects in the second chamber 43, the second piston 48 is moved axially in a direction away from the flapper valve 20. Since the second piston 48 is rigidly connected to the middle flow tube 40 and the first piston 42 via the collar 41, the middle flow tube 40 and first piston 42 are also moved towards the top sub 12. As the first piston 42 enters the first chamber 45, fluid is forced out of the port 46 and through the hydraulic fluid line 17, where it is returned to the hydraulic system. Axial movement of the middle flow tube 40 continues until the upper end of the middle flow tube 40 abuts the lower end of the upper flow tube 13 as shown in Figures 2a and 2b.

[0044] Once the second piston 48 has moved beyond the connecting line 26 between the second chamber 43 and the third chamber 23, the connecting line 26 is uncovered to allow fluid communication between the second chamber 23 and the third chamber 43. As a result, hydraulic fluid enters the third chamber 23. Fluid in the third chamber 23 forces the third piston 22 to move towards the bottom sub 16. Since the collar 28 and the flapper valve 20 are connected to the third piston 22, axial movement of the third piston 22 causes a corresponding movement of the collar 28 and flapper valve 20. The absence of the middle flow tube 40 allows the flapper valve 20 to pivot about the hinge 21 through 45°

into the throughbore 19. The flapper valve 20 is guided into position by the sealing seat 61 of the lower flow tube 60 as shown in Figs. 3a and 3b. As the flapper valve 20 travels into the sealing configuration, the valve 20 is pushed along the sealing seat 61 of the flow tube 60 thereby scraping debris from the seat 61. This self-cleaning action as the flapper valve 20 moves into position over the sealing seat 61 results in an improved seal between the valve 20 and the seat 61. In the sealing configuration, a convex face of the flapper valve 20 makes a seal against the sealing seat 61. This seal is made against a side of the flapper valve 20 that is typically in the upstream position (in other words the convex face of the flapper valve 20 faces downwards or away from the surface of the well). The line along which the seal is made is inclined approximately at an angle of 45° relative to the longitudinal axis 18 of the tubular.

[0045] Once the second piston 42 has reached its full extent of travel, the second piston 42 contacts a switch (not shown) positioned adjacent the port 46. The switch sends a command to the hydraulic system to return the middle flow tube 40 to its original position. The hydraulic system then supplies fluid via the hydraulic line 12 and through the port 46 into the first chamber 45. The hydraulic fluid urges the first piston 42 towards the flapper valve 20. This causes movement of protrusion 41 and hence the second piston 48 and the middle flow tube 40 towards flapper valve 20. Movement of the second piston forces fluid from the second piston chamber 43 and into the line 44 which returns the fluid to the hydraulic fluid system. Axial movement of the middle flow tube 40 continues until the contact edge 49 abuts the leading face of the flapper valve 20.

[0046] The throughbore 19 is now obturated by the presence of the flapper valve 20. The valve seat in the form of the sealing seat, 61 and the contact edge 49 arranged to abut the flapper valve 20 ensures that the flapper valve 20 is positively held in this position and is thus prevented from moving any further past 45° or from being unintentionally retracted. The flapper valve 20 can thus retain pressure in both directions.

[0047] The flapper valve 20 and middle flow tube 40 can be resettable downhole. The valve assembly 10 can be programmed to cause selective movement of the flapper valve 20 and middle flow tube 40 to a predetermined reset configuration. Thus, the barrier can be removed to permit two-way flow once the testing or packer setting operations have been completed. This can be achieved by actuation of the hydraulic system in reverse to perform the steps of withdrawing the middle flow tube 40 and subsequently returning the flapper valve 20 in the direction of the top sub 12, followed by moving the middle flow tube 40 to its original position against the sealing seat 61 of the lower flow tube 60.

[0048] In the arrangement shown in Figures 1a-c and 4a-c, the first piston 42 is uncovered when the contact face 49 of the middle flow tube 40 abuts the sealing seat 61 of the lower flow tube 60. According to an alternative embodiment, a thin walled flow tube could be provided to bridge this gap and substantially restrict debris from collecting in the region of the first piston 42.

[0049] Embodiments of the present invention can seal the throughbore 19 without requiring the flapper valve 20 to be rotated all the way through 90° and can seal the throughbore by being rotated substantially less than 90° which affords such a flapper valve 20 with the advantage that the flapper valve 20 can be more easily moved from the sealing configuration to the open configuration because it is less likely to be jammed by debris resting on it from above.

[0050] Although the above embodiment describes that a seal is achieved by sealing the rear face of the flapper valve 20 against the sealing seat 61, the leading face of the flapper valve 20 could alternatively or additionally seal against the contact face 49 of the middle flow tube 40. The seals between the flapper valve 20 and the flow tubes 40, 60 can be carried on the sealing seat 61 or contact edge 49 of the flow tubes 40, 60 or on the flapper valve 20. The seals can be provided by metal-to-metal contact between the sealing seat 61 and the flapper valve 20 or rubber seals can be provided in the region of contact between the flapper valve 20 and the sealing seat 61.

[0051] Modifications and improvements can be incorporated without departing from the scope of the invention. For example, the sealing line can be planar and the sealing member can be elliptical in shape and arranged to make a planar seal along the sealing line, although the flapper valve 20 shown in Figures 1 to 4 is the preferred shape because the arcuate flapper valve 20 is more space efficient.

Claims

1. A valve assembly (10) comprising:

a conduit (12, 14, 16) having a throughbore (19) and defining a longitudinal axis (18);
at least one valve seat (49, 61) provided in the throughbore of the conduit;
a sealing member (20) that is moveable relative to the at least one valve seat between an open configuration in which the throughbore of the conduit is open and a sealing configuration in which the sealing member is arranged to substantially obturate the throughbore of the conduit;
wherein in the sealing configuration, the sealing member seals against the at least one valve seat to seal the throughbore along a sealing line at least a part of which is angled relative to a direction perpendicular to the longitudinal axis of the throughbore;
characterised in that the sealing member is both pivotally and axially moveable between the open configuration and the sealing configura-

tion; and **in that** the valve assembly further comprises a sealing mechanism (80) which is selectively actuable to move the sealing member, relative to the at least one valve seat, between the open configuration and the sealing configuration.

2. A valve assembly as claimed in any preceding claim, wherein at least one face of the sealing member is curved around the longitudinal axis of the throughbore when in the open configuration, wherein the curve of the at least one face of the sealing member comprises a substantially constant radius.

3. A valve assembly as claimed in any preceding claim, wherein the sealing member is substantially spade shaped in plan and comprises a convex face and the shape of the sealing line is non-planar, and the sealing line is arranged along the convex face of the sealing member.

4. A valve assembly as claimed in any preceding claim, wherein in the sealing configuration, the sealing member substantially obturates the throughbore to restrict passage of fluids therethrough and retains pressure across the seal in at least one direction.

5. A valve assembly as claimed in claim 4, wherein the valve assembly retains pressure across the seal in both directions.

6. A valve assembly as claimed in any preceding claim, wherein the sealing line is arranged along an upstream face of the sealing member.

7. A valve assembly as claimed in any preceding claim, wherein the sealing member is pivotally coupled to the sealing mechanism and is pivotally moveable within the bore, and the sealing member further comprises pivotally attached first (28) and second (20) portions and the first portion is movable only in an axial direction, wherein the second portion is movable axially due to its attachment to the first portion as well as pivotally (21) through pivot of the second portion relative to the first portion.

8. A valve assembly as claimed in claim 7, wherein the sealing member is pivotable through less than 90° of rotation to move between the open configuration and the sealing configuration.

9. A valve assembly as claimed in any preceding claim, wherein the valve assembly further comprises a second valve seat (49) for selective sealing against a second face or the sealing member.

10. A valve assembly as claimed in claim 9, wherein both of the first (61) and second (49) valve seats move relative to the sealing member.

11. A valve assembly as claimed in either of claims 9 or 10, wherein the first valve seat is shaped to guide the sealing member towards the sealing configuration.

12. A valve assembly as claimed in any of claims 9 to 11, wherein the second valve seat is mounted on an end face of a sleeve (40) that is axially moveable within the bore of the conduit, and wherein the sealing mechanism is selectively actuable to move the second valve seat of the sleeve relative to the sealing member into and out of contact with the second face of the sealing member.

13. A valve assembly as claimed in any preceding claim, wherein the valve assembly is resettable in that it is repeatably moveable between the open and sealing configurations.

14. A valve assembly as claimed in claim 13, wherein the valve assembly comprises a reset system, the actuation of which can cause movement of the valve assembly from the sealing configuration to the open configuration, wherein the reset system is responsive to at least one of the following means selected from the group consisting of: a timer; a radio frequency signal: a pressure pulse; a mechanical driving means; and electromagnetic induction, for selective movement of the valve assembly into a predetermined configuration.

15. A valve assembly as claimed in any preceding claim, wherein the sealing member and the at least one valve seat are shaped such that movement of the sealing member relative to the valve seat from the open into the sealing configuration cleans the valve seat, wherein the self-cleaning action is achieved by contact between the sealing member and the valve seat as the sealing member is moved relative to the valve seat into the sealing configuration, wherein such moving contact between the sealing member and the valve seat is arranged to scrape debris from the valve seat.

Patentansprüche

1. Eine Ventilanordnung (10), die Folgendes beinhaltet:

eine Leitung (12, 14, 16), die eine Durchgangsbohrung (19) aufweist und eine Längsachse (18) definiert;
mindestens einen Ventilsitz (49, 61), der in der Durchgangsbohrung der Leitung bereitgestellt ist;

ein Dichtungselement (20), das relativ zu dem mindestens einen Ventilsitz zwischen einer offenen Konfiguration, in der die Durchgangsbohrung der Leitung offen ist, und einer Dichtungskonfiguration, in der das Dichtungselement angeordnet ist, um die Durchgangsbohrung der Leitung im Wesentlichen zu verschließen, bewegbar ist;
wobei das Dichtungselement in der Dichtungskonfiguration gegen den mindestens einen Ventilsitz dichtet, um die Durchgangsbohrung entlang einer Dichtungslinie, von der mindestens ein Teil relativ zu einer zu der Längsachse der Durchgangsbohrung senkrechten Richtung abgewinkelt ist, zu dichten;
dadurch gekennzeichnet, dass das Dichtungselement zwischen der offenen Konfiguration und der Dichtungskonfiguration sowohl schwenkend als auch axial bewegbar ist, und dass die Ventilanordnung ferner einen Dichtungsmechanismus (80) beinhaltet, der selektiv betätigbar ist, um das Dichtungselement relativ zu dem mindestens einen Ventilsitz zwischen der offenen Konfiguration und der Dichtungskonfiguration zu bewegen.

2. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei mindestens eine Fläche des Dichtungselements um die Längsachse der Durchgangsbohrung gekrümmt ist, wenn in der offenen Konfiguration, wobei die Krümmung der mindestens einen Fläche des Dichtungselements einen im Wesentlichen konstanten Radius beinhaltet.

3. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei das Dichtungselement in der Draufsicht im Wesentlichen spatenförmig ist und eine konvexe Fläche beinhaltet und die Form der Dichtungslinie nicht eben ist und die Dichtungslinie entlang der konvexen Fläche des Dichtungselements angeordnet ist.

4. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei das Dichtungselement in der Dichtungskonfiguration die Durchgangsbohrung im Wesentlichen verschließt, um den Durchgang von Fluiden dort hindurch zu beschränken, und den Druck über die Dichtung in mindestens einer Richtung beibehält.

5. Ventilanordnung gemäß Anspruch 4, wobei die Ventilanordnung Druck über die Dichtung in beiden Richtungen beibehält.

6. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei die Dichtungslinie entlang einer aufwärts gelegenen Fläche des Dichtungselements angeordnet ist.

7. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei das Dichtungselement schwenkend an den Dichtungsmechanismus gekoppelt ist und schwenkend innerhalb der Bohrung bewegbar ist, und das Dichtungselement ferner einen ersten (28) und zweiten (20) schwenkend angebrachten Abschnitt beinhaltet und der erste Abschnitt nur in eine axiale Richtung bewegbar ist, wobei der zweite Abschnitt aufgrund seiner Anbringung an dem ersten Abschnitt axial sowie durch Schwenkung des zweiten Abschnitts relativ zu dem ersten Abschnitt schwenkend (21) bewegbar ist.

8. Ventilanordnung gemäß Anspruch 7, wobei das Dichtungselement um weniger als 90° Drehung schwenkbar ist, um sich zwischen der offenen Konfiguration und der Dichtungskonfiguration zu bewegen.

9. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei die Ventilanordnung ferner einen zweiten Ventilsitz (49) zum selektiven Dichten gegen eine zweite Fläche oder das Dichtungselement beinhaltet.

10. Ventilanordnung gemäß Anspruch 9, wobei sich sowohl der erste (61) als auch der zweite (49) Ventilsitz relativ zu dem Dichtungselement bewegen.

11. Ventilanordnung gemäß einem der Ansprüche 9 oder 10, wobei der erste Ventilsitz geformt ist, um das Dichtungselement zu der Dichtungskonfiguration hin zu führen.

12. Ventilanordnung gemäß einem der Ansprüche 9 bis 11, wobei der zweite Ventilsitz auf einer Endfläche einer Hülse (40), die innerhalb der Bohrung der Leitung axial bewegbar ist, montiert ist, und wobei der Dichtungsmechanismus selektiv betätigbar ist, um den zweiten Ventilsitz der Hülse relativ zu dem Dichtungselement in den Kontakt und aus dem Kontakt mit der zweiten Fläche des Dichtungselements zu bewegen.

13. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei die Ventilanordnung so rücksetzbar ist, dass sie wiederholbar zwischen der offenen Konfiguration und der Dichtungskonfiguration bewegbar ist.

14. Ventilanordnung gemäß Anspruch 13, wobei die Ventilanordnung ein Rücksetzsystem beinhaltet, dessen Betätigung die Bewegung der Ventilanordnung von der Dichtungskonfiguration in die offene Konfiguration bewirken kann, wobei das Rücksetzsystem auf mindestens eines der folgenden Mittel reagiert, die aus der Gruppe ausgewählt sind, die aus Folgendem besteht: einem Zeitgeber, einem

Hochfrequenzsignal, einem Druckimpuls, einem mechanischen Antriebsmittel und einer elektromagnetischen Induktion, zur selektiven Bewegung der Ventilanordnung in eine vorbestimmte Konfiguration.

15. Ventilanordnung gemäß einem der vorhergehenden Ansprüche, wobei das Dichtungselement und der mindestens eine Ventilsitz so geformt sind, dass die Bewegung des Dichtungselements relativ zu dem Ventilsitz von der offenen Konfiguration in die Dichtungskonfiguration den Ventilsitz säubert, wobei die Selbstsäuberungsaktion durch den Kontakt zwischen dem Dichtungselement und dem Ventilsitz erreicht wird, während das Dichtungselement relativ zu dem Ventilsitz in die Dichtungskonfiguration bewegt wird, wobei ein derartiger Bewegungskontakt zwischen dem Dichtungselement und dem Ventilsitz angeordnet ist, um Ablagerungen von dem Ventilsitz zu schaben.

Revendications

1. Un assemblage de soupape (10) comprenant :

un conduit (12, 14, 16) présentant un trou débouchant (19) et définissant un axe longitudinal (18) ;
au moins un siège de soupape (49, 61) fourni dans le trou débouchant du conduit ; un élément de fermeture hermétique (20) qui peut être déplacé par rapport à l'au moins un siège de soupape entre une configuration ouverte dans laquelle le trou débouchant du conduit est ouvert et une configuration fermée de façon hermétique dans laquelle l'élément de fermeture hermétique est disposé pour obturer substantiellement le trou débouchant du conduit ;
dans lequel, dans la configuration fermée de façon hermétique, l'élément de fermeture hermétique se ferme de façon hermétique contre l'au moins un siège de soupape afin de fermer de façon hermétique le trou débouchant le long d'une ligne de fermeture hermétique dont au moins une partie est angulaire par rapport à une direction perpendiculaire à l'axe longitudinal du trou débouchant ;
caractérisé en ce que l'élément de fermeture hermétique peut être déplacé à la fois de façon à pivoter et de façon axiale entre la configuration ouverte et la configuration fermée de façon hermétique ; et **en ce que** l'assemblage de soupape comprend en outre un mécanisme de fermeture hermétique (80) qui peut être actionné de façon sélective pour déplacer l'élément de fermeture hermétique, par rapport à l'au moins un siège de soupape, entre la configuration ouverte et la configuration fermée de façon hermétique.

2. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel au moins une face de l'élément de fermeture hermétique est incurvée autour de l'axe longitudinal du trou débouchant lorsqu'il se trouve dans la configuration ouverte, la courbe de l'au moins une face de l'élément de fermeture hermétique comprenant un rayon substantiellement constant.

3. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel l'élément de fermeture hermétique est substantiellement en forme de bêche en plan et comprend une face convexe et la forme de la ligne de fermeture hermétique est non plane, et la ligne de fermeture hermétique est disposée le long de la face convexe de l'élément de fermeture hermétique.

4. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel, dans la configuration fermée de façon hermétique, l'élément de fermeture hermétique obture substantiellement le trou débouchant afin de restreindre le passage de fluides à travers celui-ci et retient la pression de part et d'autre du joint dans au moins une direction.

5. Un assemblage de soupape tel que revendiqué dans la revendication 4, dans lequel l'assemblage de soupape retient la pression de part et d'autre du joint dans les deux directions.

6. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel la ligne de fermeture hermétique est disposée le long d'une face amont de l'élément de fermeture hermétique.

7. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel l'élément de fermeture hermétique est couplé de façon à pivoter au mécanisme de fermeture hermétique et peut être déplacé de façon à pivoter au sein de l'alésage, et l'élément de fermeture hermétique comprend en outre une première portion (28) et une deuxième portion (20) attachées de façon à pivoter et la première portion peut être déplacée seulement dans une direction axiale, la deuxième portion pouvant être déplacée de façon axiale du fait de son attache à la première portion, ainsi que de façon à pivoter (21) par un pivotement de la deuxième portion par rapport à la première portion.

8. Un assemblage de soupape tel que revendiqué dans la revendication 7, dans lequel l'élément de ferme-

ture hermétique peut pivoter sur moins de 90° de rotation afin de se déplacer entre la configuration ouverte et la configuration fermée de façon hermétique.

9. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel l'assemblage de soupape comprend en outre un deuxième siège de soupape (49) destiné à se fermer de façon hermétique et sélective contre une deuxième face ou l'élément de fermeture hermétique.

10. Un assemblage de soupape tel que revendiqué dans la revendication 9, dans lequel le premier siège de soupape (61) et le deuxième siège de soupape (49) se déplacent tous deux par rapport à l'élément de fermeture hermétique.

11. Un assemblage de soupape tel que revendiqué dans l'une ou l'autre des revendications 9 et 10, dans lequel le premier siège de soupape est formé pour guider l'élément de fermeture hermétique vers la configuration fermée de façon hermétique.

12. Un assemblage de soupape tel que revendiqué dans une quelconque des revendications 9 à 11, dans lequel le deuxième siège de soupape est monté sur une face d'extrémité d'un manchon (40) qui peut être déplacé de façon axiale au sein de l'alésage du conduit, et dans lequel le mécanisme de fermeture hermétique peut être actionné de façon sélective pour déplacer le deuxième siège de soupape du manchon par rapport à l'élément de fermeture hermétique en et hors de contact avec la deuxième face de l'élément de fermeture hermétique.

13. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel l'assemblage de soupape peut être remis à l'état initial en ce qu'il peut être déplacé de façon répétée entre les configurations ouverte et fermée de façon hermétique.

14. Un assemblage de soupape tel que revendiqué dans la revendication 13, dans lequel l'assemblage de soupape comprend un système de remise à l'état initial, dont l'actionnement peut amener un déplacement de l'assemblage de soupape de la configuration fermée de façon hermétique à la configuration ouverte, dans lequel le système de remise à l'état initial est sensible à au moins un des moyens suivants sélectionnés dans le groupe composé de : un chronomètre ; un signal de fréquence radio ; une impulsion de pression ; un moyen d'entraînement mécanique ; et une induction électromagnétique, pour un déplacement sélectif de l'assemblage de soupape dans une configuration prédéterminée.

15. Un assemblage de soupape tel que revendiqué dans une revendication précédente quelconque, dans lequel l'élément de fermeture hermétique et cet au moins un siège de soupape sont formés de telle sorte que le déplacement de l'élément de fermeture hermétique par rapport au siège de soupape de la configuration ouverte à la configuration fermée de façon hermétique nettoie le siège de soupape, dans lequel l'action autonettoyante est obtenue par contact entre l'élément de fermeture hermétique et le siège de soupape à mesure que l'élément de fermeture hermétique est déplacé par rapport au siège de soupape jusque dans la configuration fermée de façon hermétique, dans lequel un contact par déplacement de la sorte entre l'élément de fermeture hermétique et le siège de soupape est disposé pour racler des débris du siège de soupape.

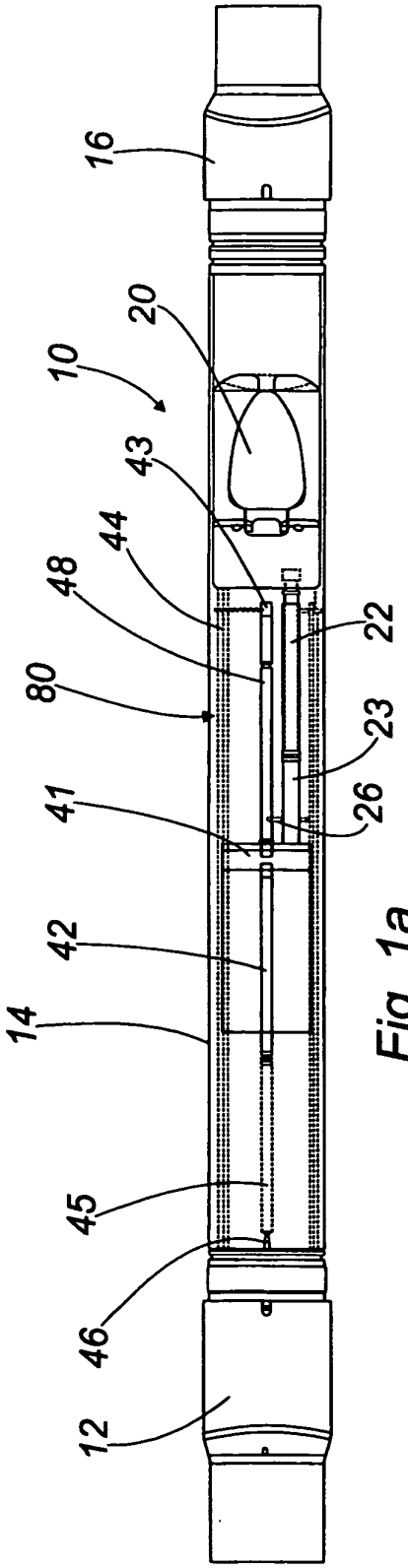


Fig. 1a

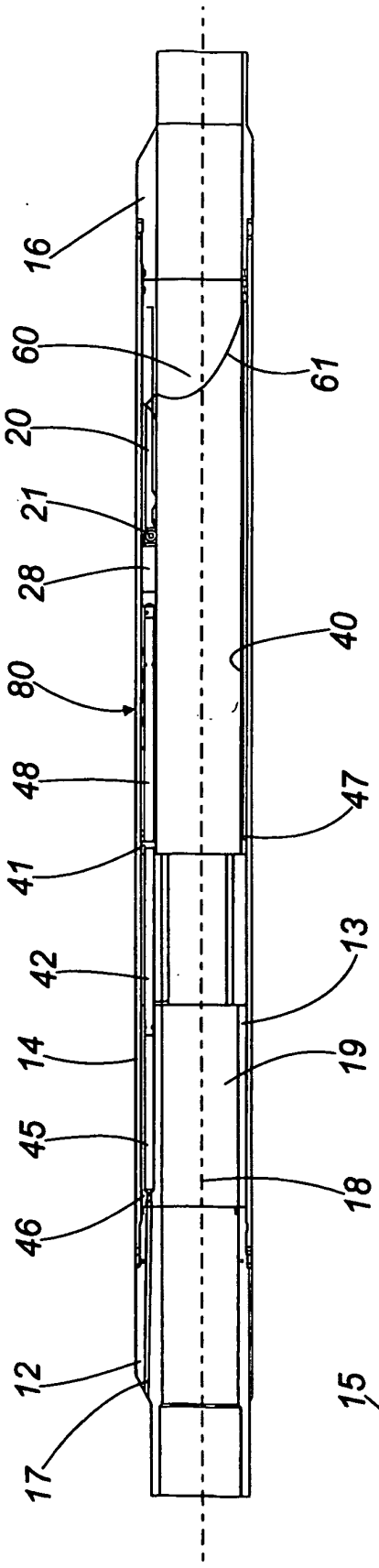


Fig. 1b

Section A-A

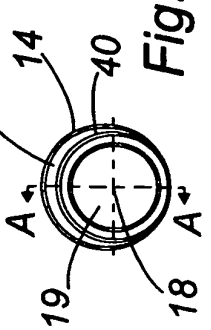


Fig. 1c

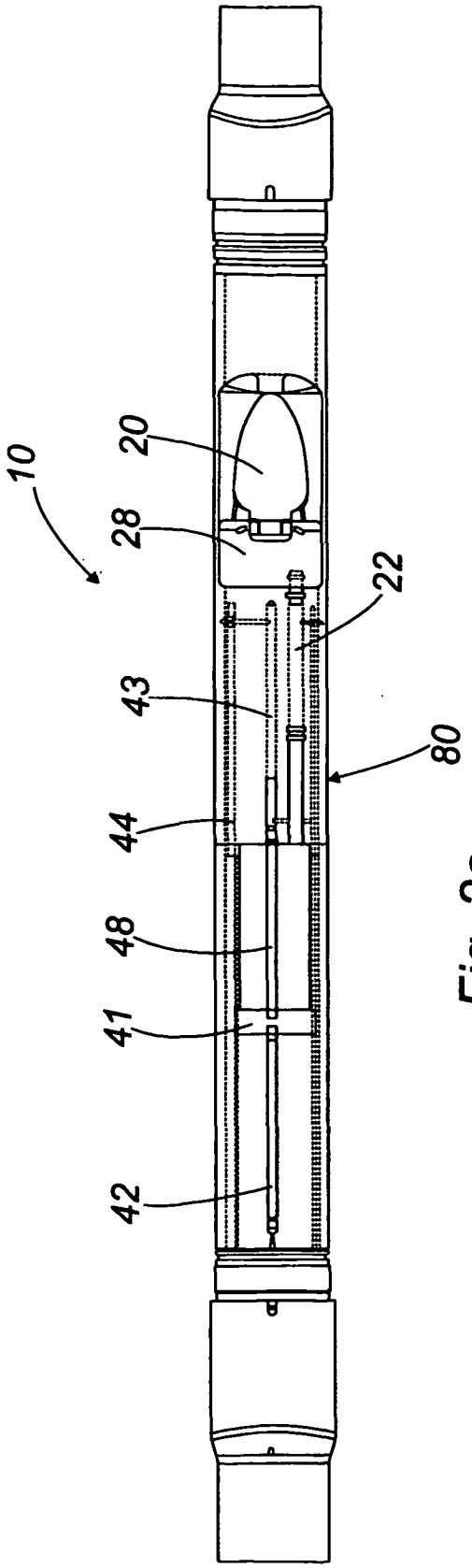


Fig. 2a

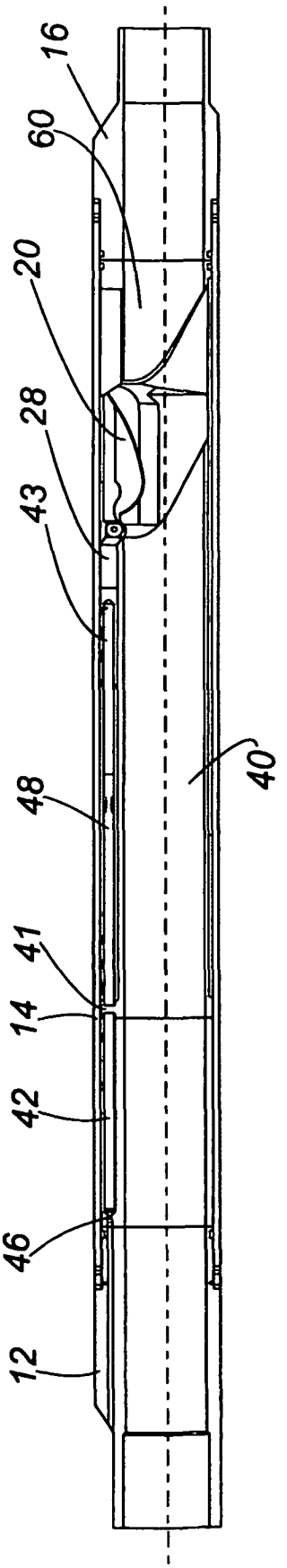


Fig. 2b

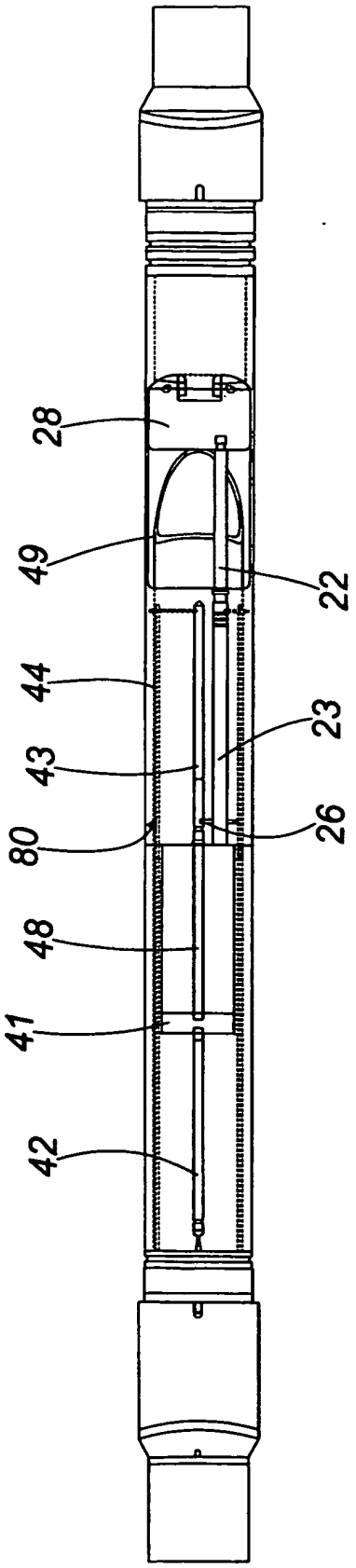

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Fig. 3a

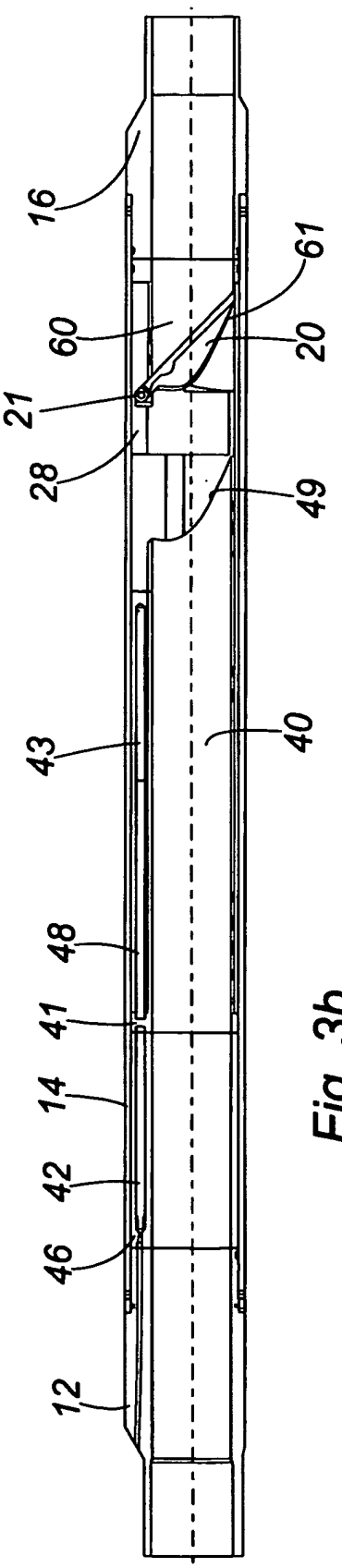

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12

Fig. 3b

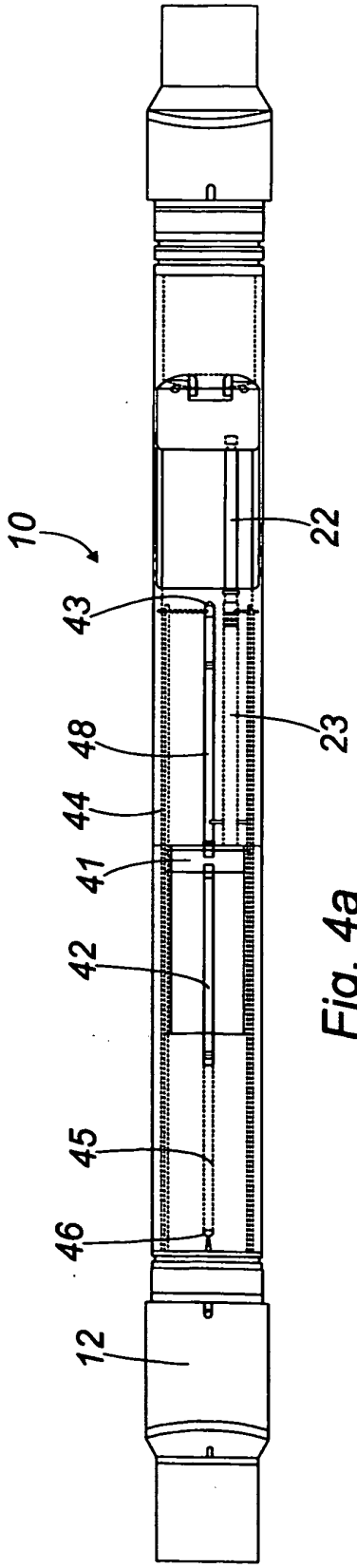


Fig. 4a

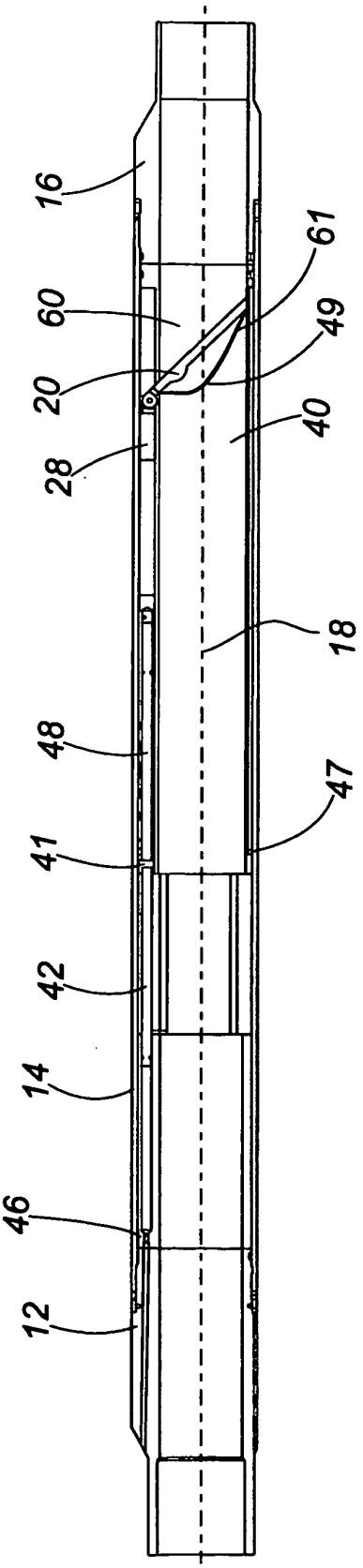


Fig. 4b
Section D-D

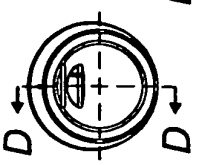


Fig. 4c

REFERENCES CITED IN THE DESCRIPTION

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